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EOLE BALLOONS PROJECT
DESCRIPTION OF THE DESTRUCTIVE EQUIPMENT

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1. EQUIPMENT FUNCTION

2. DESCRIPTION OF THE DESTRUCTION DEVICES

3. FUNCTIONING PRINCIPLE

4. MECHANICAL AND ELECTRICAL CHARACTERISTICS

5. TECHNOLOGY

6. PERFORMANCE

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EOLE BALLOONS PROJECT
DESCRIPTION OF THE DESTRUCTIVE EQUIPMENT

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ABSTRACT. The following items are described for the destruct device on the eole ballon: technical specifications, acceptance criteria, performance checks, enviromental tests and compatibility tests.

1. EQUIPMENT FUNCTION

/2*

This equipment is to assure destruction of the balloon on order from the EOLE satellite. However, for ground safety reasons due to nacelle weight, one must avoid a severe drop. The destruction affect is, therefore, limited to assure a maximum speed of descent not exceeding 2 m per second.

2. DEFINITION OF DESTRUCTION DEVICE

An "operational destruction device" is a system composed of a cabled electrical detonator mounted on a specially made stopper, the ends of the twisted cable wires equipped with connectors and shunted before operation. The stopper holding the detonator is then screwed into a valve held on the bottom part of the balloon envelope.

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*Numbers in the margin indicate the pagination in the original foreign text.

3. FUNCTIONING PRINCIPLE

The firing of the detonator induces breakage of the valve flush with the locking nut, but the balloon is not damaged. The existing overpressure is immediately eliminated by a large leak at the hole thus created (diameter 15 mm). The balloon does not deflate right away: an helium bubble remains in the upper part.

4. MECHANICAL AND ELECTRICAL CHARACTERISTICS

4.1. Detonator

4.1.1. Type

DF 68 A ATS

Device: miniature electrical with detonating charge.

Filling: 57 mg lead nitride, 50 mg hexogen.

4.1.2. Mechanical Characteristics

Mass (with cabling)

- 3.5 gr

Dimensions

- Cylindrical body, 4.18 mm diameter, 7.5 mm long.
- Twisted cabling: 200 mm long.

4.1.3. Electrical Characteristics /3

Resistance of the fuse bridge:

1,4 Ω R Ω 2 Ω

Insulation resistance between the shunted wires and the detonator body:

R > 10 MΩ (50 V DC)

Threshold of nonfunctioning:

0.3 VDC

Nominal firing pulse:

1,5 A / 20 ms.

4.2. Detonator Holding Stopper

Machined part of DELRIN to be later screwed in the balloon valve.

4.3. Operational Unit

See Figure 1.

The cabling wires are twisted and placed under a heat collapsing sheath. Connectors are inserted at the ends. Contact between the detonator and the detonator holding stopper is assured by glueing.

5. TECHNOLOGY

5.1. Material Used

5.1.1. Detonator

Secondary charge: hexogen

- Weight: 50 mg $\pm$ 0.1
- Grain size: $200\mu \leq G \leq 400\mu$

Primary charge: lead nitride

- Weight: 40 mg $\pm$ 0.1
- Grain size: ≤ 210

Initiating charge: lead nitride

- Weight: 17 mg $\pm$ 0.1
- Grain size: $200 \leq G \leq 400$

Cell: Z 80 CN 18 08

Fuse bridge: TOPHFT C T 13, 42 mic. diameter

Resistivity (20°C): 112.05 microamps/cm

Length: $2\ mm < L < 2,5\ mm$

Pin Holder Block: polystyrene

Pins: Z 3 CN 18/10

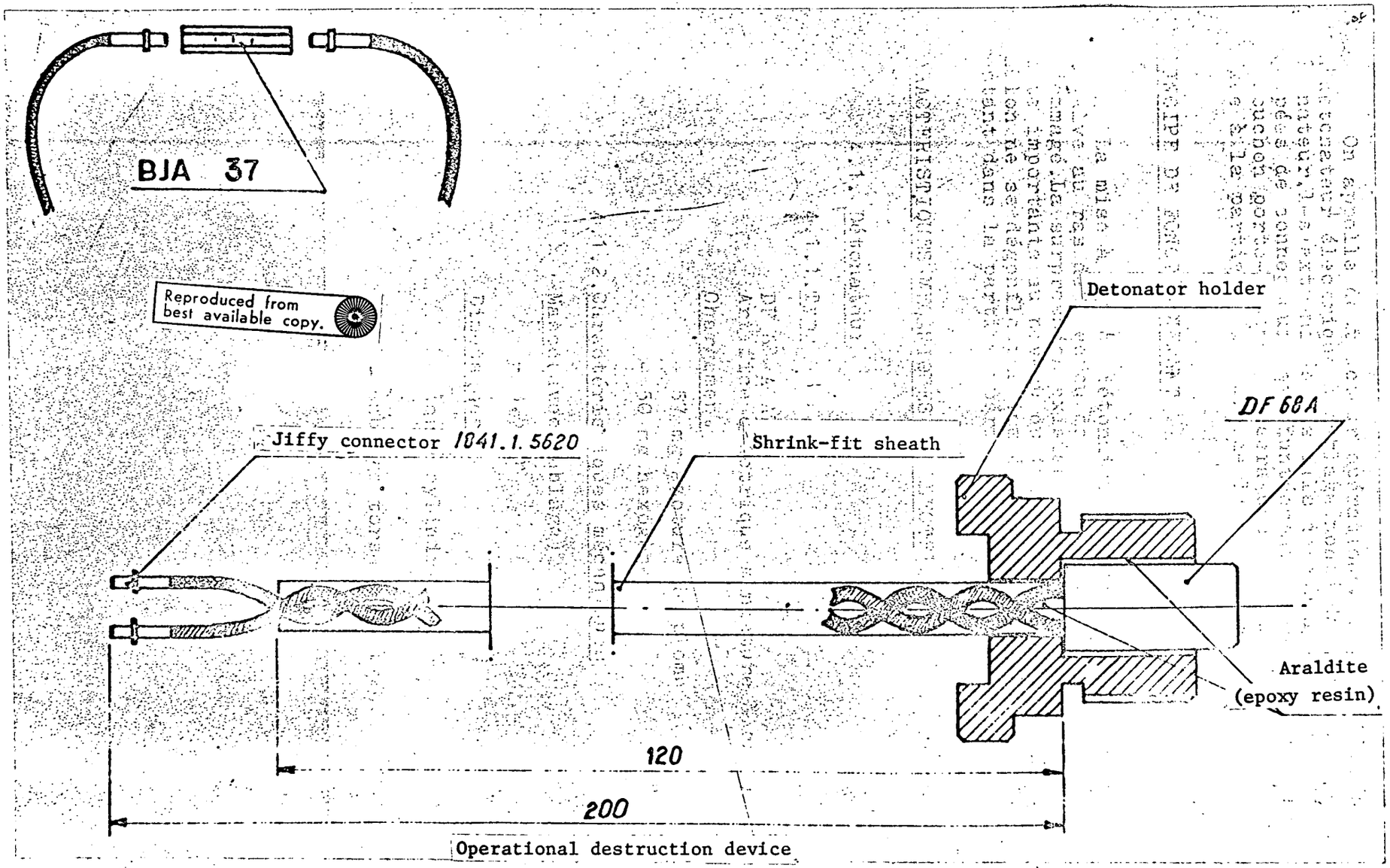

Figure 1. Jiffy connectors.

Cabling:

FILECA AIR 1722-0.2, Gauge AWG 24

Linear resistance: 100 Ohms/Km, mean O.D. 1mm

Length (twisted): 200 mm

Heat Collapsing sheath:

RAYCHEM TFF 14

Temperature range: -60°C to +250°C

Length: 120 mm

Connectors:

DEUTSCH JIFFY JONCTION 1841-1-5620 inserts

5.1.2. Detonator holding stopper (and valve):

DELRIN

5.1.3. Contact detonator-stopper:

ARALDITE

5.2. Manufacture

5.2.1. Detonator

- Charge:

  Primary and secondary, compression 1500 bars.

  Initiator, powder form.

- Fuse bridge: solder
- Pin holder: injection
- Cabling wires: soldered to the pins and twisting of the wires.
- Heat collapsing sheath: treated twice at 300°C.
- Connectors: inserted with DEUTSCH tool 15/500/20/7

5.2.2. Detonator holding stopper

- Machining of the DELRIN according to drawing.

5.2.3. Contact detonator-stopper

- Glueing with Araldite (cold polymerization).
  A shunt DEUTSCH TSE 20 is mounted with inserting tool M 15/570/20 prior to storage.

6. PERFORMANCE

6.1. Power of Destruction Test

Bores holes in lead disks 3.4 mm thick of B quality. Test performed on a lot of 55 operational units. Hole diameter: 5.5 to 6 mm.

Balloon Destruction Test

Test performed on 30 operational units mounted on balloon valves. Test performed on the ground, the valve being fixed on the balloon. The valve was cut flush at the locking nut. Mean hole diamter: 15 mm. Balloon not damaged. The overpressure is neutralized immediately, but the balloon does not deflate totally; a helium bubble remains in the upper part.

6.2. Environmental Testing

Vibration tests

Tests performed on half the samples during acceptance controls. Sinusoidal oscillations of 1 mm amplitude, 50 cps, 30 min, in two perpendicular directions.

Weathering tests

Tests performed on half the samples during acceptance controls.

Heat: - temperature +45°C
- relative humidity 95%
- 3 hours duration

Cold: - temperature -70°C
- 3 hours duration

Environmental tests of acceptance on the whole system of balloons EOLE

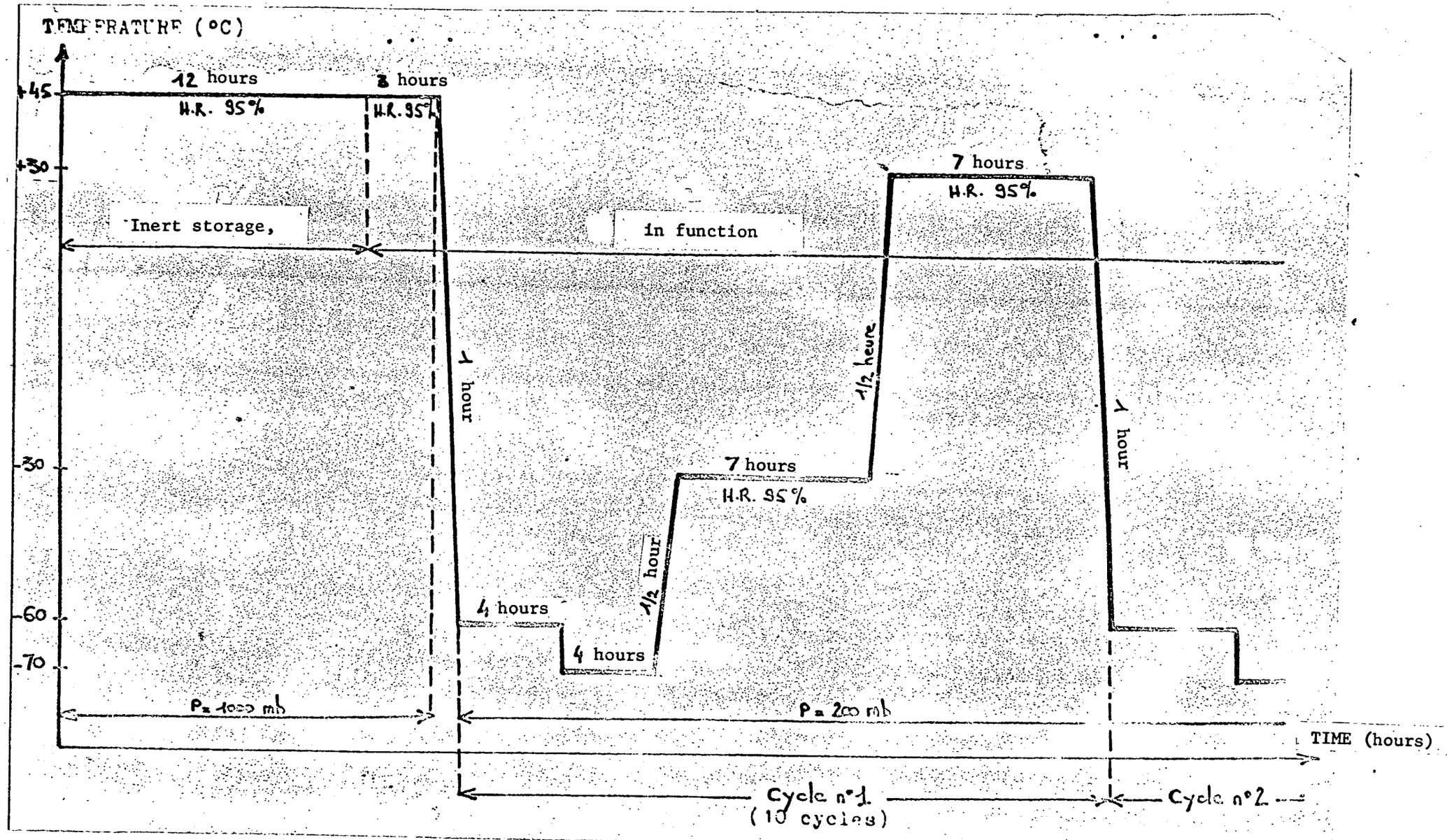

Figure 2. Environmental tests "EOLE cycle".

Tests performed on 30 operational units mounted on balloon valves.
Cycle: pressure, temperature, hygrometry.
10 cycles of 24 hours. /6
See Figure 2.
100% functioning of the destruction devices at end of cycle.

6.3. Compatibility Tests

Battery-electronics, nacelle-destruction device compatibility tests
Control of the possibility of simultaneous emission and destruction. The battery is capable of furnishing the current necessary for destruction while the emission continues. The battery does not collapse due to the heavy current drain due to destruction.

Compatibility test between ground emitter and destruction device.
It is to be verified that the ground emission induction in the destruction device circuit is insufficient to provoke firing of the detonator. The test was performed during the phases of storage, manipulation, control and mounting, launch.

Considering the precautions taken (twisting of the cabling wires) no h.f. coupling was detected.

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